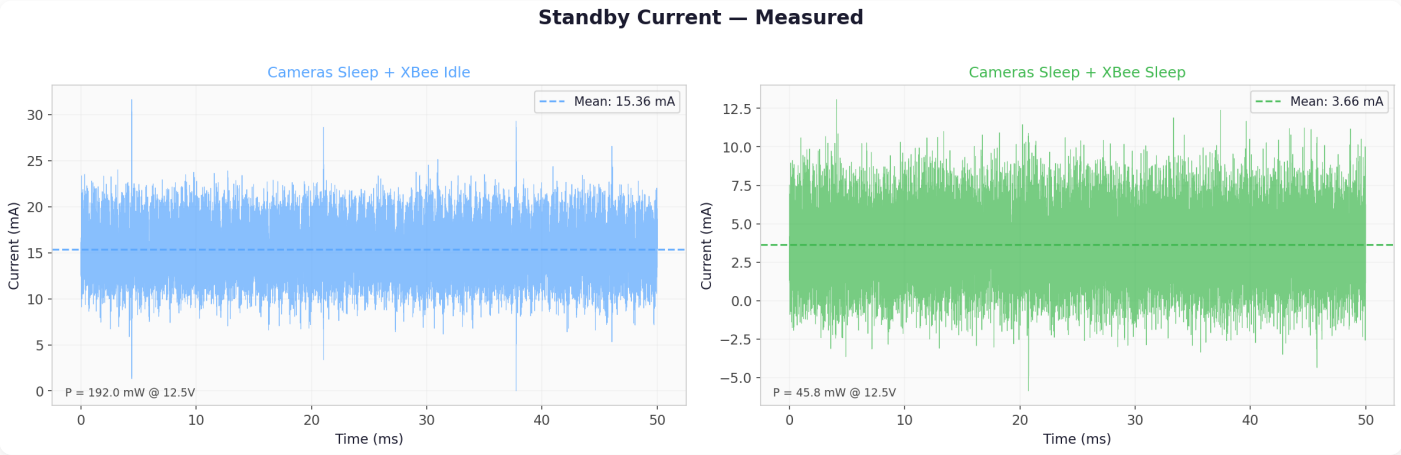
Ranger Power Analysis Report

Measured with Current Ranger (mA range, 1mV=1mA) at 12.5V supply

1. Standby Current

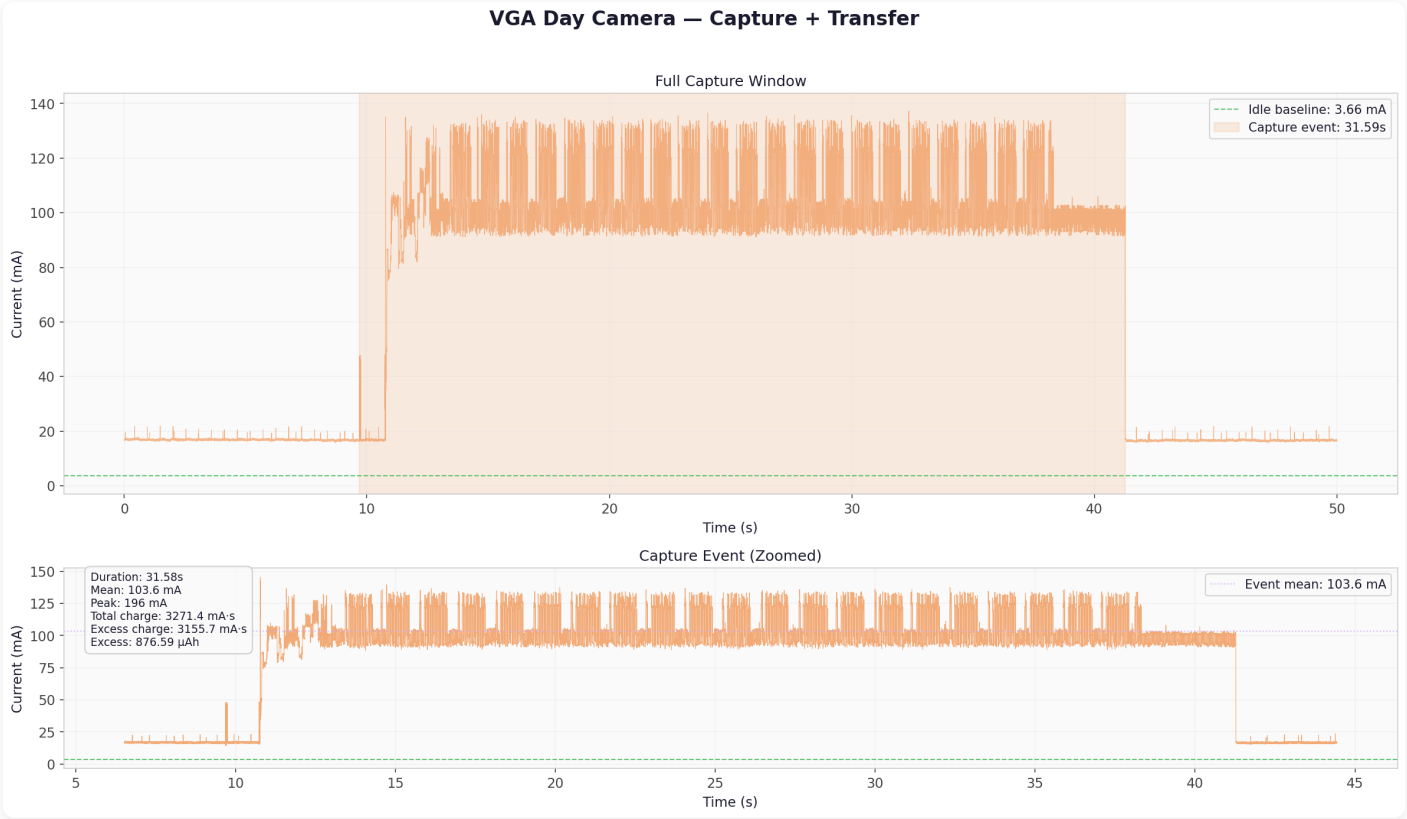
State	Current (mA)	Power (mW)	Notes
Cameras Sleep + XBee Idle	15.36	192.0	Current state (pre-optimization)
Cameras Sleep + XBee Sleep	3.66	45.8	**Target idle** (MCU + PIR only)
XBee overhead	+11.70	+146.3	≈44 mA on 3.3V rail



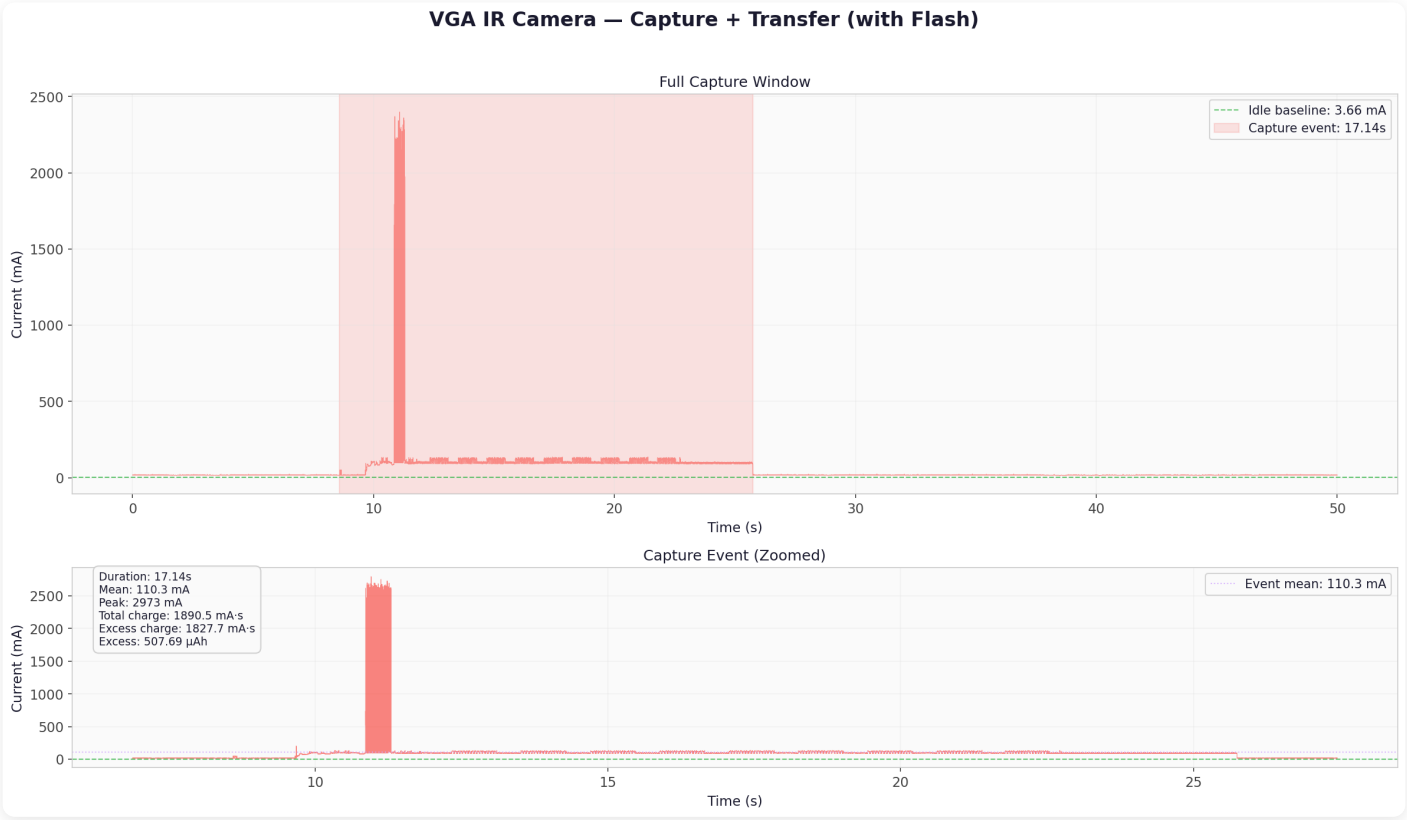
2. Capture Event Profiles

Metric	Day (VGA)	IR Night (VGA + Flash)
Duration	31.58s	17.14s
Mean current	103.6 mA	110.3 mA
Peak current	196 mA	2973 mA
Excess charge	3155.7 mA·s	1827.7 mA·s
Energy per capture	877 µAh	508 µAh

Day Camera Capture + Transfer



IR Camera Capture + Transfer (with Flash)



3. Battery Life Projections

> Activity split: ~70% day / 30% night (14h day, 10h night)

9Ah LiFePO4

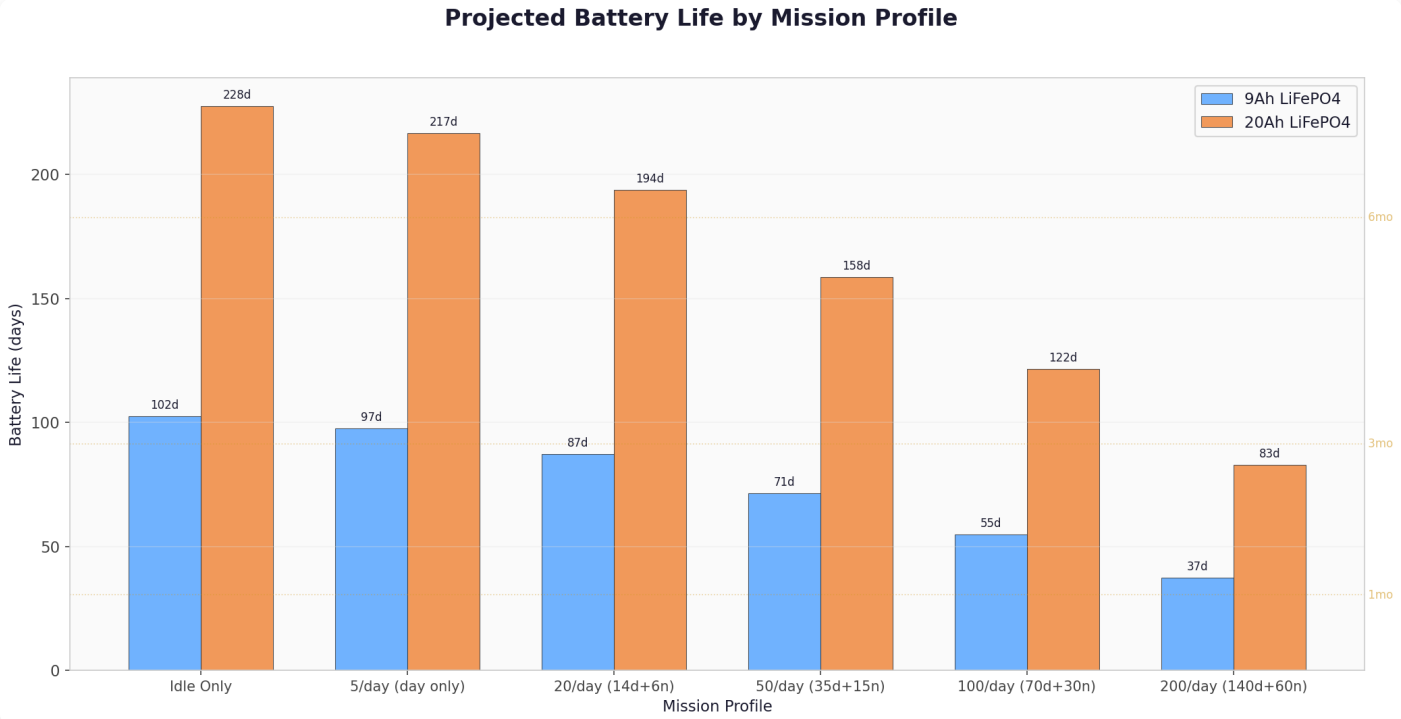
Profile	Day	Night	Idle	Day	Night	Total	Avg	Life
Idle Only	0	0	87.9	0.0	0.0	87.9	3.66	**102d**
5/day (day only)	5	0	87.9	4.4	0.0	92.3	3.85	**97d**
20/day (14d+6n)	14	6	87.9	12.3	3.0	103.2	4.30	**87d**
50/day (35d+15n)	35	15	87.9	30.7	7.6	126.2	5.26	**71d**
100/day (70d+30n)	70	30	87.9	61.4	15.2	164.5	6.85	**55d**
200/day (140d+60n)	140	60	87.9	122.7	30.5	241.1	10.04	**37d**

Columns: caps/day | mAh/day | life

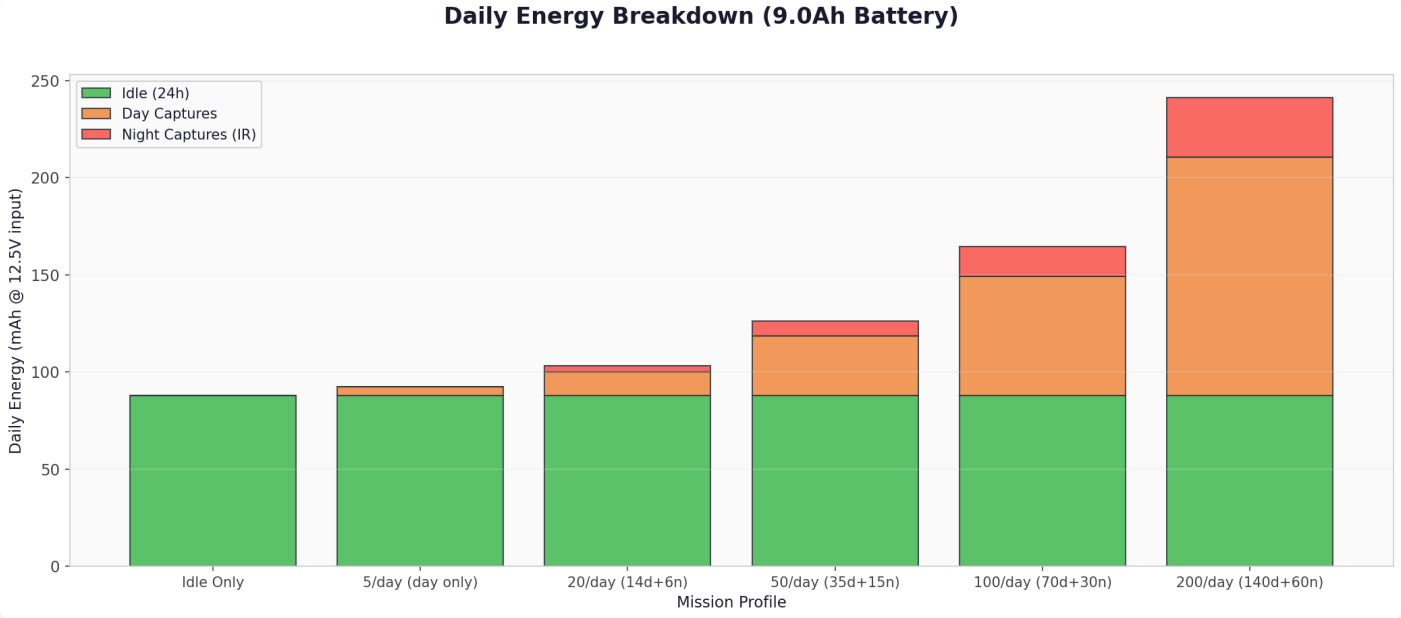
20Ah LiFePO4

Profile	Day	Night	Idle	Day	Night	Total	Avg	Life
Idle Only	0	0	87.9	0.0	0.0	87.9	3.66	**228d**
5/day (day only)	5	0	87.9	4.4	0.0	92.3	3.85	**217d**
20/day (14d+6n)	14	6	87.9	12.3	3.0	103.2	4.30	**194d**
50/day (35d+15n)	35	15	87.9	30.7	7.6	126.2	5.26	**158d**
100/day (70d+30n)	70	30	87.9	61.4	15.2	164.5	6.85	**122d**
200/day (140d+60n)	140	60	87.9	122.7	30.5	241.1	10.04	**83d**

Columns: caps/day | mAh/day | life



4. Daily Energy Breakdown



5. Deployment Analysis (750h / 31 days)

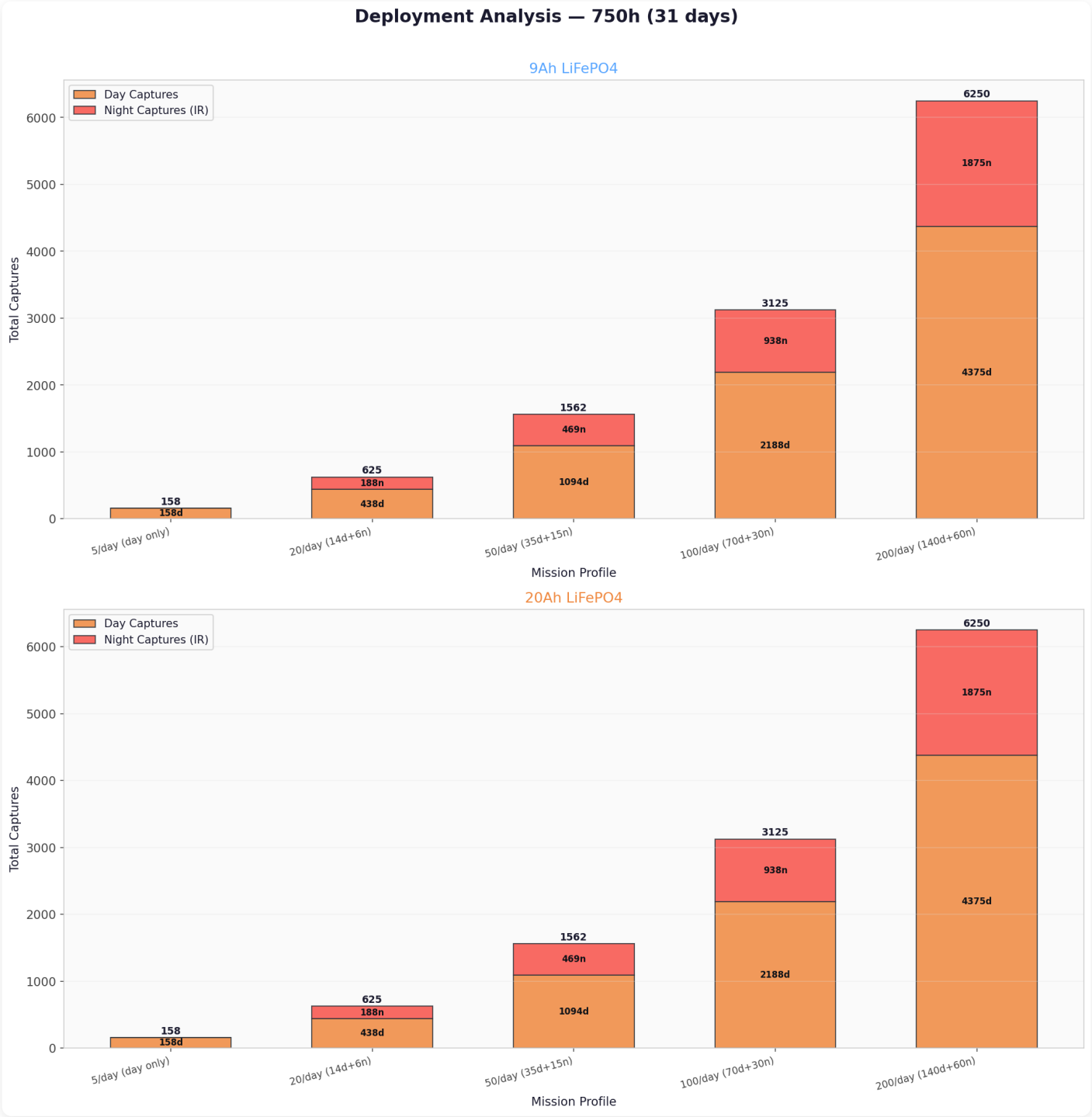
> Total captures over a fixed 750-hour deployment window

9Ah LiFePO4 (9,000 mAh)

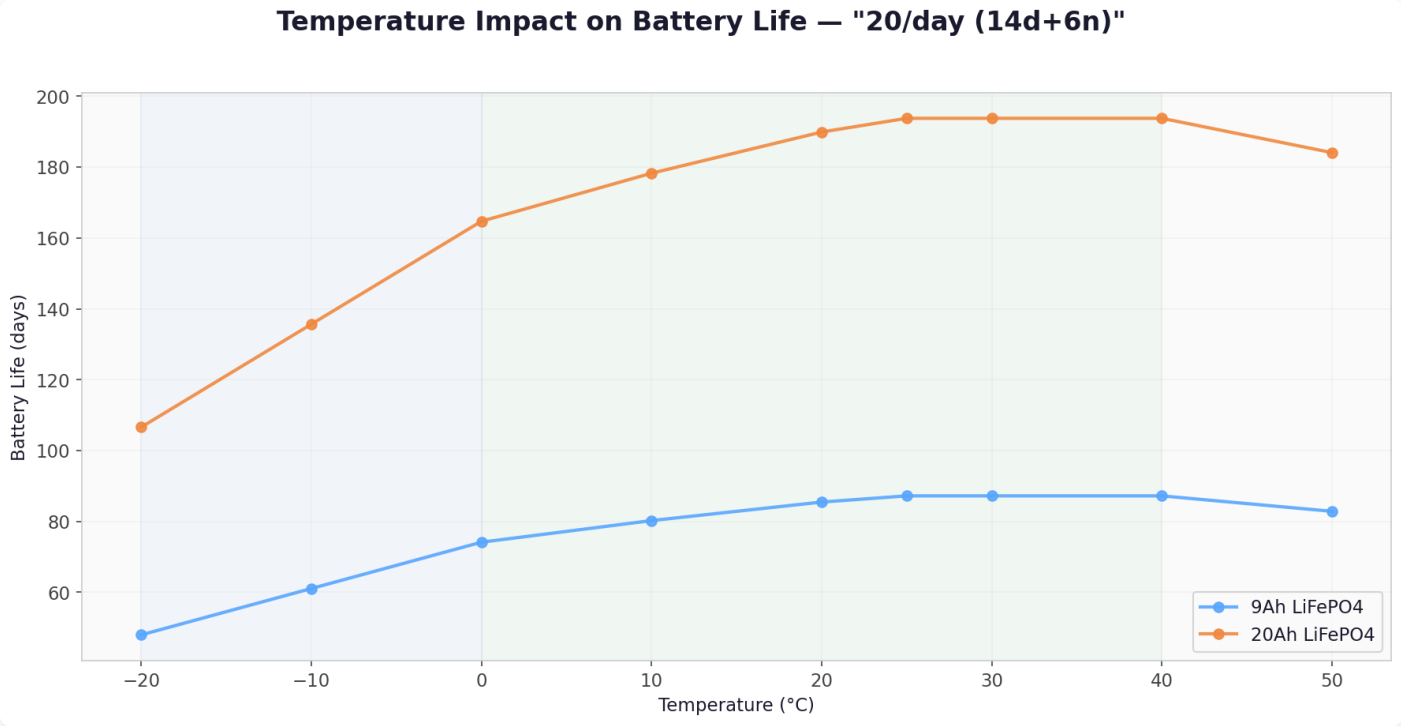
Profile	Day Caps	Night Caps	Total Caps	Energy Used
5/day (day only)	158	0	**158**	2885 mAh (32%)
20/day (14d+6n)	438	188	**625**	3225 mAh (36%)
50/day (35d+15n)	1094	469	**1562**	3943 mAh (44%)
100/day (70d+30n)	2188	938	**3125**	5140 mAh (57%)
200/day (140d+60n)	4375	1875	**6250**	7534 mAh (84%)

20Ah LiFePO4 (20,000 mAh)

Profile	Day Caps	Night Caps	Total Caps	Energy Used
5/day (day only)	158	0	**158**	2885 mAh (14%)
20/day (14d+6n)	438	188	**625**	3225 mAh (16%)
50/day (35d+15n)	1094	469	**1562**	3943 mAh (20%)
100/day (70d+30n)	2188	938	**3125**	5140 mAh (26%)
200/day (140d+60n)	4375	1875	**6250**	7534 mAh (38%)



6. Temperature Impact



7. Key Findings

- **True idle**: 3.66 mA @ 12.5V (45.8 mW) — MCU + PIR only
- **XBee idle adds**: +11.70 mA (4.2× increase)
- **IR flash peak**: 2973 mA (37.2W instantaneous)
- **Day capture**: 877 µAh per event (31.6s)
- **IR capture**: 508 µAh per event (17.1s)
- **XBee Pin Sleep** is the #1 optimization (11.7 mA saved = 76% of idle draw)
- **Idle dominates**: Even at 200 caps/day, idle is 36% of daily energy